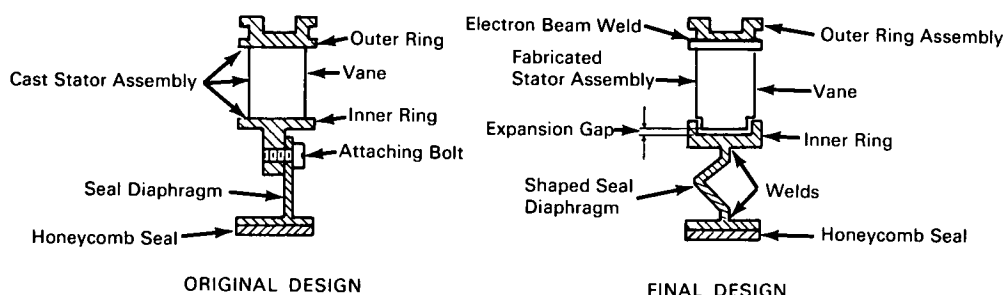


# NASA TECH BRIEF



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## Design Eliminates Radial Thermal Expansion in Turbine Stator Components



ORIGINAL DESIGN

FINAL DESIGN

### The problem:

To devise a method for eliminating the unacceptable stress levels created in turbine stator components because of differential thermal expansion. Thermal studies revealed that turbine stator vanes heat faster than the shroud rings during transient conditions, causing a thermal gradient that also affects the seal diaphragm under steady-state conditions. Calculations also showed that an excessive state of stress would occur in the vanes, inner ring, attach bolts, and seal diaphragm. Repetition of this thermal expansion condition could result in thermal fatigue cracks, etc.

### The solution:

Incorporation of a semifloating design, in which the stator vanes are retained by the outer ring assembly and radially piloted in the inner ring.

### How it's done:

For easy fabrication, the vanes are electron-beam welded to the outer shroud. The inner ring is modified with slip-fit sockets for each vane, providing sufficient radial clearance for thermal growth. Each vane acts as a radial pin to release completely any vane thermal growth-induced stresses.

The seal diaphragm is shaped to provide increased radial flexibility by replacing the attaching bolts with a weld joint. This configuration provides sufficient load paths for the primary pressure loads, while allowing adequate freedom for thermal growth.

### Note:

No additional documentation is available. Inquiries may be directed to:

Technology Utilization Officer  
Marshall Space Flight Center  
Huntsville, Alabama 35812  
Reference: B68-10531

### Patent status:

Inquiries about obtaining rights for the commercial use of this invention may be made to NASA, Code GP, Washington, D. C. 20546.

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